www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(7): 737-740

www.thepharmajournal.com
Received: 14-04-2023
Accepted: 18-05-2023

Thokala Mounika
Department of Livestock Products Technology, PV Narsimha Rao Telangana Veterinary University, Telangana, Hyderabad, Telangana, India

M Sahityarani
Department of Livestock Products Technology, PV Narsimha Rao Telangana Veterinary University, Telangana, Hyderabad, Telangana, India

Corresponding Author:
Thokala Mounika
Department of Livestock Products Technology, PV Narsimha Rao Telangana Veterinary University, Telangana, Hyderabad, Telangana, India

Quality evaluation of chicken sausages incorporated with moringa leaf powder

Thokala Mounika and M Sahityarani

Abstract
The present study was undertaken to evaluate the effect of different levels of moringa leaf powder on the quality characteristics of chicken sausages. The moringa leaf powder was incorporated at two different levels viz. 1.5% and 2.5% and analyzed for various physicochemical and sensory characteristics of chicken sausages. Addition of at different levels significantly affected the proximate composition of the chicken sausages. The crude fibre content was found to be significantly higher in chicken sausages incorporated with 2.5% level of moringa leaf powder. A significant (p<0.05) increase in the, PH, emulsion stability, cooking yield and water holding capacity values was observed in chicken sausages with 2.5%. The mean sensory scores of the products like appearance, color, flavor, texture and overall acceptability were higher for 1.5% level of incorporation. Although the result variations between 1.5% and 2.5% are very less but 1.5% may be preferred over 2.5% based on the overall acceptability scores.

Keywords: Chicken sausages, sensory attributes, cooking yield, water holding capacity

1. Introduction
Muscle foods are recognized as important source of all essential nutrients and contain high biological value proteins, fatty acids, vitamins, minerals, trace elements and bioactive compounds (Yadav *et al*., 2016) [18]. In spite of being nutritious, meat is generally deficient in complex carbohydrate dietary fibre, (Vendrell-Pascuas *et al*., 2000, Mounika *et al*., 2021) [16, 8] which is most essential for human health for control of body weight, reduction of cardiovascular diseases and maintenance of normal physiological and biochemical process (Talukedar *et al*., 2010) [13]. Due to increasing consciousness among consumers about the nutrition and changes in socio economic lifestyle meat consumers are now days demanding healthier meat and meat products with high fibre which could be incorporated into products while processing to make them more healthful (Verma *et al*., 2010) [17]. Fibres are mostly concentrated in cereals, pulses, fruits and vegetables. *Moringa oleifera,* a possible functional ingredient source of dietary fibre and antioxidant is customarily known as horse radish tree or drumstick tree. M. *oleifera* is the most known species studied from the Moringaceae family and used in human and animal application (Sreelatha *et al*., 2009) [12]. Moringa oleifera contain good quantities of important minerals, proteins, vitamins, β-carotene, amino acids and phenolic compounds and used as nutritional and nutraceutical resources for human and animal diets. The flowers and leaves serve as good source of protein and dietary fibre with an adequate profile of amino acids and ash (Madane *et al*., 2019, Gopalakrishna *et al*., 2016 [7, 3], Rocchetti *et al*., 2019) [11]. M. oleifera leaves are of special interest in food preservation because in addition to contributing taste and aroma to foods, it also contains a variety of bioactive substances, which are of considerable use in extending shelf life (Muthukumar *et al*., 2012) [9]. Considering the benefits of both dietary fibre and antioxidants in a single material, the present study was undertaken with an effort to understand and optimize the incorporation of MLP in different levels to broiler chicken sausages.

2. Materials and Methods
Broiler birds were procured from local farms. Birds were starved for 6 hours before slaughter then slaughtered and dressed in the Department of Livestock Products Technology, CVSc Rajendranagar as per standard procedures and guidelines. Dressed carcasses after post mortem examination were packed in LDPE bags and stored at 4±1 °C for 12 hours. The dressed carcasses were deboned manually next day and all the visible fat and connective tissue was trimmed off and frozen at -18 °C until further use. Meat was used for product preparation after partial thawing at 4 °C for 12-15 hrs, other non-meat ingredients like salt, sugar, binder, red

chili powder, vegetable oil and other ingredients for spice mix were procured from local market from Hyderabad. Condiment mix was prepared by using onion and garlic paste in 3:1 ratio. Trials were conducted initially to determine the optimum inclusion level of moringa leaf powder to be incorporated and further study was done by addition of lean meat with 2 levels 1.5% and 2.5%.

2.1 Preparation of Moringa Leaf Powder

Fresh leaves purchased from local market at Hyderabad were thoroughly washed under running tap water to remove extraneous matter, chopped and dried under shade for 8 h followed by final drying in hot air oven at 50 °C for 2 h. The dried leaves were ground in a home mixer grinder and sieved through a fine mesh. Fine powder was put in a polyethylene bag, which was closed and stored in a cool dry place.

2.2 Preparations of chicken sausages with moringa leaf powder

Frozen chicken meat was thawed in the refrigerator (4±1 °C) and minced using meat mincer (Model: Sirman TC 32 Colorado, Italy) first by 8mm plate followed by 4mm plate. Chicken sausages were prepared using ingredients as per the recipe presented in Table-1 viz., Control and moringa leaf powder(MLP) incorporated at 1.5% as T_1 and 2.5% as T_2 levels replacing lean meat was made. Emulsion was prepared in bowl chopper (Model: MADO Garrant MTK 661, Germany) by mixing ingredients in a sequence. MLP was added along with minced meat in bowl chopper and chopped for 30 seconds. Salt, sugar, phosphate, ice were added sequentially and blended for 60 seconds then oil was added and blended for 30-60 sec for emulsion formation. Dry spice mix, chili powder, wet condiment mix and binder were added sequentially and blended for 30 sec in bowl chopper. The emulsions of control, T_1 and T_2 was separately stuffed into synthetic cellulose casings (SCC21) using horizontal sausage stuffer and cooked at 80 °C/20 min in moist heat. After cooking the sausages were cooled to room temperature and packed in LDPE pouches under aerobic packaging. The packed product was stored at refrigeration temperature (4±1 °C) for further analysis

Table 1: Formulations of chicken sausages incorporated with MLP at 1.5%, and 2.5% levels.

	Control	T_1	T_2
MEAT (%)	85	83.5	82.5
FAT (%)	15	15	15
Moringa leaf powder	-	1.5%	2.5%
Non Meat Ingredients			
Salt%	2		
Sugar%	1		
Binder(wheat flour)%	3		
Dry Spice mix%	1.5		
Wet condiments mix%	4		
Red chilli powder%	0.25		
Polyphosphate (stpp)%	0.3		

2.3 pH

The pH of the emulsion and product was determined by following the method of Trout *et al*., 1992.5 gms of sample was blended with 45 ml of distilled water in motor and pestle for one minute. The pH of the suspension is recorded by dipping combined glass electrode of a digital pH meter (Model: Hanna HI 2211) after calibration with three standard buffers pH 4.0, 7.0 and 14.

2.4 Emulsion stability

Emulsion stability was carried out by adopting method of Townsend *et al*., (1968) [14] with some modifications. About 25 g of raw emulsion was placed in low density polyethylene (LDPE) bags. Bags with weighed samples were sealed and placed in a water bath and cooked at 80 °C for 20 minutes. The bags were removed from water bath, cut open and the cook out fluid drained off and the cooked samples were weighed. Emulsion stability was calculated as percent by dividing final weight with initial emulsion weight.

2.5 Cooking yield

The weight of sausages before and after cooking was recorded. Cooking yield was calculated as Percentage by obtaining ratio between weight of the sausages after cooking and raw sausage as per the method suggested by Murphy *et al*., 1975 [19].

2.6 Proximate compositions

Proximate parameters viz., moisture, protein, fibre, fat and ash measurement were done according to the methods described by AOAC (1995) [2]. Moisture (oven drying), protein (Kjeldahl distillation), fat (Soxhlet method), crude fiber and ash (muffle furnace) content of both control and treated sausages were determined by using established procedure as described by AOAC.

2.7 Sensory evaluation

Sensory evaluation of the product was carried out on a 9 point hedonic scale by a semi trained five members taste panel as per the procedure described by Keeton (1983) [6]. The data thus obtained was subjected to statistical analysis using SPSS MAC, version 20.0, SPSS Chicago (US).

3. Results and Discussion

Table 2: Effect of incorporation of different levels of moringa leaf powder on proximate composition of chicken meat sausages.

Parameters	Control	T_1	T_2
Moisture	68.94 ± 0.68^{ab}	67.86 ± 0.54^{b}	66.07 ± 0.98^{c}
Protein	14.29 ± 0.36^{c}	15.03 ± 0.25^{b}	15.72 ± 0.31^{a}
Fat	13.18 ± 0.21^{c}	13.63 ± 0.16^{b}	14.06 ± 0.10^{a}
Ash	2.13 ± 0.18^{c}	2.43 ± 0.05^{b}	2.61 ± 0.07^{a}
Fibre	0.89 ± 0.05^{c}	1.55 ± 0.03^{b}	2.13 ± 0.08^{a}

The means with different superscripts in the same row differed significantly ($p<0.05$)

3.1 Proximate Composition

The proximate composition of chicken sausages incorporated with 1.5% and 2.5% along with controls are shown in table2, results showed that the moisture content of chicken sausages decreased with the addition of MLP. T_1 showed non-significant decrease ($p>0.05$) in moisture content with control, whereas incorporation of MLP at 2.5% (T_2) showed significant ($p<0.05$) decrease in moisture content with control and T_1. This might be due to increase levels of solid content in T_2, similar findings were reported by Al-juhaimi *et al*., (2016) [1] with incorporation of moringa olifera seed powder in beef. Protein content of the treated chicken sausages was 14.29% in (control), 15.03% in (T_1) and 15.72% in (T_2). The high protein content in moringa olifera would have contributed to

increased protein content in T_2. A significant increase in the lipid content of the product was observed with incorporation of MLP at different levels. This may be due to higher fat retention in the sausages by addition of MLP; there is also a possible connection between cooking yield and fat. Similar trend was observed by Madane *et al*., (2019) [7] who reported the increase in content of fat in chicken nuggets with incorporation of moringa flower extract. The ash content of various treatments differed significantly which might be due to high mineral content of MLP as they were rich source of minerals such as Ca, K, Zn, Mn, Fe and Cu. Madane *et al*., (2019) [7] also noticed the increase in ash content of meat nuggets with increase in percentage of moringa. Statistical analysis showed that crude fibre content of chicken sausages increased significantly with incorporation of MLP at different levels. Higher dietary fibre of MLP might have contributed to high CF content of chicken sausages. Similar trend was observed Verma *et al*., (2010) [17] who found that incorporation of guava powder significantly improved the total dietary fibre in meat nuggets.

Table 3: Effect of incorporation of different levels of MLP on Physico chemical properties of chicken sausages

Parameters	Control	T_1	T_2
Emulsion pH	6.08 ± 0.02^c	6.17 ± 0.05^b	6.33 ± 0.04^a
Product pH	6.13 ± 0.02^c	6.24 ± 0.05^b	6.37 ± 0.04^a
Emulsion stability	94.39 ± 0.09^c	95.41 ± 0.06^b	96.5 ± 0.12^a
Cooking yield	96.38 ± 0.15^c	97.13 ± 0.09^b	97.74 ± 0.13^a
WHC	45.49 ± 0.44^c	51.81 ± 0.36^b	58.37 ± 0.84^a

The means with different superscripts in the same row differed significantly ($p<0.05$)

3.2 Physicochemical properties

Table-3 shows the effect of incorporation of moringa leaf powder (MLP) on physicochemical properties of meat sausages.

3.2.1 PH

PH of emulsion increased with increase in level of incorporation. The highest pH was observed in T_2 (6.33) followed by T_1 (6.17) and control (6.08) which might be due to the alkalinity of MLP. The results obtained in the present study were in concomitant with that of Hazra *et al*., (2011) [5] who observed the addition of moringa leaf extract increased the pH values of cooked ground buffalo meat significantly ($p<0.05$).

3.2.2 Emulsion stability

The emulsion stability values of control T_1 and T_2 were depicted in table 3, the emulsion stability was observed to be significantly higher ($p<0.05$) for the treatment T_2 incorporated with 2.5% level MLP. This increase in emulsion stability might be attributed due to higher dietary fibre in MLP (Madne *et al*., 2019) [7]. Similar trend was noticed by Govind *et al*., (2013) [4] and Mounika *et al*., (2012) [9] in oat flour incorporated chicken sausages and meat balls respectively.

3.2.3 Cooking yield

Cooking yield of various treatments ranged from 96.38% to 97.74% as shown in table 3. There was significant increase among the control and treatments, the increase in cooking yield of T_2 could be due to high amount of dietary fibre and its ability to bind more water. The results in the study are in line with observations of (Al-Juhaimi *et al*., 2016) [1], who found the inclusion of Moringa olifera seed powder at 6% improved the cooking properties of beef patties.

3.2.4 Water holding capacity

As per the results demonstrated in Table 3, a significant increase in water holding capacity was observed with increase in the percentage of incorporation. The WHC capacity of treatments and control ranged between 45% to 58%. The results are in accordance with (Muthukumar *et al*., 2012 and Hazra *et al*., 2011) [9, 5] who observed the increase in WHC with addition of Moringa leaf extract in goat meat patties and ground buffalo meat respectively.

Table 4: Effect of incorporation of different levels of MLP on organoleptic qualities of chicken meat sausages

Parameters	Control	T_1	T_2
Appearance	7.05 ± 0.04^c	7.25 ± 0.09^a	7.15 ± 0.06^b
Flavor	6.97 ± 0.08^b	7.25 ± 0.16^a	6.89 ± 0.22^c
Texture	7.07 ± 0.07^b	7.24 ± 0.13^a	7.21 ± 0.18^a
Juiciness	7.03 ± 0.03^b	7.23 ± 0.09^a	7.26 ± 0.06^a
Overall acceptability	7.28 ± 0.10^c	7.73 ± 0.12^a	7.46 ± 0.16^b

The means with different superscripts in the same row differed significantly.

3.3 Sensory

The sensory scores of chicken sausages incorporated with various levels of MLP were shown in table-4. The chicken sausages treated with 1.5% MLP showed significantly ($p<0.05$) higher appearance scores followed by T_2 (2.5%) and control. The color changes might be due to action of free radicals and aerobic bacteria on myoglobin (Hazra *et al*., 2011 and Sreelatha *et al*., 2019) [5, 12]. Significantly ($p<0.05$) higher flavor scores of T_1 (1.5%) might be due to effective inhibition of lipid peroxidation (Nath *et al*. 2016) [10]. Texture and juiciness of various treatments showed a similar trend. The treated samples differed significantly ($p<0.05$) with control but there was no significant difference between T_1 and T_2. Overall acceptability scores of control and treatment differed significantly ($p<0.05$). Chicken sausages treated with 1.5% MLP showed significantly higher scores compared to 2.5%. Lower overall acceptability scores of T_2 (2.5%) might be attributed to slight bitterness of moringa leaf powder. Hazra *et al*., (2011) [5] also observed significantly higher overall acceptability scores in cooked ground meat incorporated with drumstick leaf extract (1, 1.5 and 2%).

4. Conclusion

It is concluded that developed chicken sausages incorporated with MLP were nutritiously superior, highly acceptable and available at low cost. The results of the study revealed that addition of two different levels of moringa leaf powder at 1.5% and 2.5% can successfully be used as a food or meat additive due to its strong effect in preventing off-flavor formation and also in improving the organoleptic quality of cooked meat.

5. Acknowledgement

I would like to acknowledge, Department of Livestock Products Technology, CVSc Rajendranagar, PVNRTU, Hyderabad for facilitating the research work.

6. Conflict of interest

Conflict of interest does not exist

6. References

1. Al-Juhaimi F, Ghafoor K, Hawashin MD, Alsawmahi ON, Ghafoor K. Effects of different levels of Moringa (Moringa oleifera) seed flour on quality attributes of beef burgers. CyTA Journal of Food. 2016;14:1-9.
2. Association of Official Analytical Chemists (AOAC). Official methods of analysis 16th Ed. Virginia, USA: Association of Official Analytical Chemist; c1995
3. Gopalakrishnan L, Doriya K, Kumar DS. Moringa oleifera: A review on nutritive importance and its medicinal application. Food Science and. Human Wellness. 2016;5:49-56.
4. Govind V, Prabhakar K, Eswara Rao B, Naga Mallika E. Eating quality of spent hen meat sausages with oat flour and corn flour. International Journal of Food, Agriculture and Veterinary Sciences. 2013;3(1):247-253.
5. Hazra S, Biswas S, Bhattacharyya D, Das SK, Khan A. Quality of cooked ground buffalo meat treated with the crude extracts of Moringa oleifera (Lam.) leaves. Journal of Food Science Technology. 2011;49(2):240-245.
6. Keeton. Effects of fat and NaCl or phosphate levels on the chemical and sensory properties of pork patties. Journal of Food Science. 1983;48:878-881.
7. Madne P, Das AK, paterio M, Nanda Pk, Bandyopadhya S, Jagtap P, *et al*. Drumstick (*Moringa oleifera*) Flower as an Antioxidant Dietary Fibre in Chicken Meat Nuggetsfoods 2019;8(8):307.
8. Mounika, sahithyarani. Development and quality evaluation of oat flour incorporated spent hen meat balls.The pharma innovation. 2021;10(8):289-291.
9. Muthukumar M, Naveena BM, Vaithiyanathan S, Sen AR, Sureshkumar. Effect of incorporation of Moringa oleifera leaves extract on quality of ground pork patties. Journal of Food Science Technology. 2012;51:3172-3180.
10. Nath PM, Kumar V, Praveen PK, Ganguly S. A comparative study on green tea extract and rosemary extract on quality characteristics of chevon patties. International Journal of science Environment and Technology. 2016;5(3):1680-8-11.
11. Rocchetti G, Blasi F, Montesano D, Ghisoni S, Marcotullio MC, Sabatini S, *et al*. Impact of conventional/non-conventional extraction methods on the untargeted phenolic profile of *Moringa oleifera* leaves. Food Research International. 2019;115:319-327.
12. Sreelatha S, Padma PR. Antioxidant activity and total phenolic content of Moringa oleifera leaves in two stages of maturity. Plant Foods for Human Nutrition. PubMed. 2009;64:303-311.
13. Talukder S, Sharma DP. Development of dietary fiber rich chicken meat patties using wheat and oat. Journal of Food Science and Technology. 2010;47:224-229.
14. Townsend WE, Witnauer LP, Rillof JA, Swift CE. Comminuted meat emulsion: Different thermal analysis for fat transition. Food Technolog. 1968;22:319-323.
15. Trout ES, Hunt MC, Johnson DE, Claus JR, Kastner CL, Kropf DH, *et al*. Chemical, physical, and sensory characterization of ground beef containing 5 to 30 percent fat. Journal of Food Science. 1992;57:25-29.
16. Vendrell-Pascuas S, Castellote-Bargallo AI, LopezSabater MC. Determination of insulin in meat products by high performance liquid chromatography with refractive index detection. Journal of chromatography. 2000;881:591-597.
17. Verma AK, Banerjee k. Dietary fibre as functional ingredient in meat products: a novel approach for healthy living: A review. Journal of Food Science Technology. 2010;47:247-257.
18. Yadav S, Malik A, Pathera A, Islam R, Sharma D. Development of dietary fiber enriched chicken sausages by incorporating corn bran, dried apple pomace and dried tomato pomace. Nutrition and Food Science. 2016;46:16-29.
19. Murphy EW, Criner PE, Gray BC. Comparisons of methods for calculating retentions of nutrients in cooked foods. Journal of agricultural and food chemistry. 1975 Nov;23(6):1153-1157.